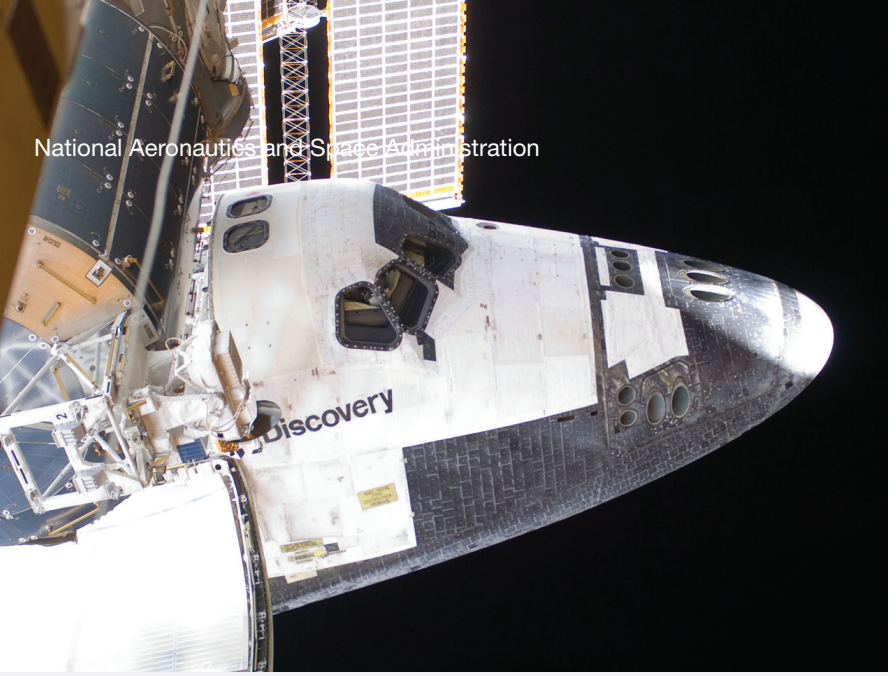


Information Technology and Software

Improved Nondestructive Evaluation (NDE) of Advanced Nonmetallic Structural Composites

Infrared (IR) contrast analysis and imaging augments and improves flash IR thermography

Researchers at NASA's Johnson Space Center (JSC) have developed novel techniques for post-processing of flash IR thermography data, providing efficient and cost-effective enhancements to NDE of nonmetallic structural composites for myriad applications. Compatible with commercial IR thermography products, this suite of tools provides both quantitative and qualitative data analysis capabilities and reliable detection and characterization of anomalies in composite structures. Calibration techniques provide detailed, systematic analysis of flash thermography data comparable to that used in advanced pulse/echo ultrasonic testing, offering accuracy not currently available for NDE of composite materials.

BENEFITS

- Comprehensive—provides both quantitative and qualitative data about flaws
- Detailed—offers accurate insights into defect shape, size, depth, and location
- Competitive—provides the most precise and detailed characterization of flaws and anomalies
- Cost-effective—lowers cost of implementation through hardware-system compatibility and ability to augment single-sided IR data processing methods
- Accurate—improves flaw detection sensitivity with reflection correction
- Efficient—extracts and constructs images quickly and simply, enabling swifter and more accurate evaluation of thermographic data
- Easy to use—allows for analysis of data in a manner that is similar to pulse/echo ultrasonic testing, making it familiar to technicians

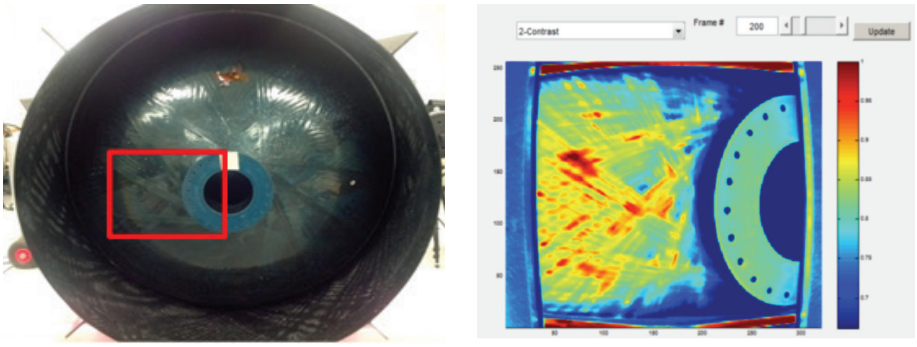
technology solution

THE TECHNOLOGY

When using flash infrared thermography to evaluate materials, variations in the thermal diffusivity of the material manifest themselves as anomalies in the IR image of the test surface. Post-processing of this raw IR camera data provides highly detailed analysis of the size and characterization of anomalies, including both quantitative and qualitative information. NASA has created complementary contrast tools that offer highly precise measurements with these benefits:

- The peak contrast and peak contrast time profiles provide quantitative interpretation of the images, including detailed information about the size and shape of the anomalies.
- The persistence energy and persistence time profiles provide highly sensitive data giving indications of the worst areas of the detected anomalies.
- Peak contrast, peak time, persistence time, and persistence energy measurements also enable monitoring for flaw growth and signal response to flaw size analysis.
- The normalized temperature contrast profile provides more sensitive response than image contrast, allowing the system to detect smaller flaws

JSC's suite of software and tools offers a cost-effective and efficient way to provide more comprehensive, detailed, and accurate NDE detection and characterization of subsurface defects in nonmetallic composite materials than is possible with currently available commercial thermography software, which does not use image contrast or temperature contrast and therefore provides less accurate characterization of defects. Furthermore, because JSC's software normalizes and calibrates data, it provides more stable measurements and greatly minimizes errors due to operator and camera variability.



The NASA developed software has a wide variety of applications including nondestructive testing of aerospace structures.

APPLICATIONS

This suite of tools can be applied to NDE using flash IR thermography of any nonmetallic advanced structural composite, such as those used in myriad industries:

Aerospace – aircraft and fuselage structure, airfoils, turbine blades

Power generation – turbine blades, pipelines

Chemical and petrochemical – pipelines, fuel tanks

Marine – marine vehicle bodies, fuel tanks, pressure vessels

High-performace automotive – racecar bodies and structures

Construction – bridges

PUBLICATIONS

U.S. Patent 8,577,120

More Information

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